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ABSTRACT

This paper reports a comprehensive "meta-review" and synthesis of research on variables related to learning, including both cognitive and affective schooling outcomes. A conceptual framework was developed, encompassing 228 items related to school learning, organized "a priori" into 30 scales within 6 categories ordered roughly from more distal to more proximal factors: (1) state and district variables; (2) out of school contextual variables; (3) school-level variables; (4) student variables; (5) program design variables; and (6) implementation, classroom instruction, and climate variables. Search and selection procedures yielded 179 selected handbook and annual review chapters, commissioned papers, and other authoritative reviews. Content analysis yielded over 3,700 ratings of the strength of influence of the variables on learning. They confirm the primacy of student, classroom, home, and community influences on learning relative to more distal policy variables such as state and district characteristics. They also highlight the importance of metacognition, classroom management, quantity of instruction, classroom interactions, classroom climate, and the peer group. (Contains 204 references.) (Author/DB)

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VARIABLES IMPORTANT TO LEARNING: A META-REVIEW OF REVIEWS OF THE RESEARCH LITERATURE

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Abstract

This paper reports a comprehensive "meta-review" and synthesis of research on variables related to learning, including both cognitive and affective schooling outcomes. A conceptual framework was developed, encompassing 228 items related to school learning, organized a priori into 30 scales within six categories. Search and selection procedures yielded 179 selected handbook and annual review chapters, commissioned papers, and other authoritative reviews. Content analysis yielded over 3,700 ratings of the strength of influence of the variables on learning. They confirm the primacy of student, classroom, home, and community influences on learning relative to more distal policy variables such as state and district characteristics. They also highlight the importance of metacognition, classroom management, quantity of instruction, classroom interactions, classroom climate, and the peer group.

Variables Important to Learning: A Meta-Review of Reviews of the Research Literature

Educational research has identified a large number of variables related to school learning. Indeed, such a multiplicity of distinct influences on achievement have been found that educators may be perplexed as to which items are most important. Educational researchers, policy makers, and practitioners all require clearer guidance concerning the relative importance of different learning influences and the particular variables most likely to maximize school learning. To address this need, a comprehensive review and synthesis of handbooks, review annuals, and other highly synthetic prior reviews was undertaken. Its purpose was to characterize the most authoritative scholarly opinion about ways to optimize educational outcomes across a range of educational conditions and settings. This research synthesis is distinguished by its comprehensiveness, its orientation toward practical school improvement strategies, and its focus on comparing the relative contributions of different items to learning. To organize the synthesis, a conceptual framework was developed which draws heavily upon major theoretical models of school learning. Before turning to this framework, the evolution of these earlier theoretical models is briefly described.

Evolution of Models of School Learning

J. B. Carroll (1963) introduced educational researchers to models of school learning in his Teachers College Record aptly entitled article, "A Model of School Learning." In his model, he put forth six constructs: aptitude, ability to comprehend instruction, perseverance, clarity of instruction, matching the task to student characteristics, and opportunity to learn. These constructs, which succinctly capture the psychological influences on school learning, became a point of departure for other models to follow. The 1960s and 1970s were marked by the introduction of several additional important models of learning, including those of Bruner (1966), Bloom (1976), Harnischfeger and Wiley (1976), Glaser (1976), and Bennett (1978).

All of these models recognize the primary importance of student ability, and included constructs such as aptitude, prior knowledge, verbal IQ, and pupil background. Most of them also address the importance of motivation, by employing such constructs as perseverance, self concept of the learner, and attitude toward school subject matter. This acknowledgement of individual difference variables among learners stood in contrast to more narrowly psychological studies of influences on learning, which generally treated individual differences as a source of error, focusing instead on instructional-treatment variables (Hilgard, 1964).

In addition to student variables, each of the models of school learning noted above also gave salience to constructs developed from studies of classroom instruction. These constructs varied in generality, some being as broad as "instructional events" or "clarity of instruction," and others as narrow as "use of cues" or "feedback and correctives."

Although later models brought some refinement in the ways in which individual difference variables and instructional variables were defined and the ways in which they were related to one another, the primary contributions of more recent models have been in extending the range of influences considered. Haertel, Walberg, and Weinstein (1983), for example, identified nine theoretical constructs that exhibit consistent causal influences on academic learning: student age or developmental level, ability (including prior achievement), motivation, amount or quantity of instruction, quality of instruction, psychological environment of the classroom, influence of the home, influence of the peer group outside of school, and exposure to mass media. They showed that previous models of school learning neglected extramural and social-psychological influences.

The evolution of models of school learning was further advanced with the introduction of models of adaptive instruction (Wang & Lindvall, 1984; Wang & Walberg, 1985). School-based implementation of models of adaptive instruction are designed to help schools create learning environments that maximize each student's opportunities for success in school. It paid particular attention to

new variables associated with instructional delivery systems, program design, and implementation. It attended in particular to those features that Glaser (1982) referred to as the "large practical variables," and included efficient allocation and use of teacher and student time, a practical classroom management system, systematic teacher feedback and reinforcement of student learning behavior and progress, instructional interactions based on the diagnosed learning needs of individual students, and flexible administrative and organizational patterns responsive to program implementation and staffing needs.

Another contribution to models of school learning came from sociologists concerned with the identification of effective schools. Ronald Edmonds (1979) is most strongly associated with this identification of variables associated with exceptionally effective schools, especially for the urban poor. Significant contributions to effective schools models were also made by Brookover (1979), Brookover and Lezotte (1979), and Rutter, Maughan, Mortimore, Ouston, and Smith (1979). Illustrations of the types of variables characterizing effective schools include degree of curriculum articulation and organization, schoolwide staff development, parental involvement and support, schoolwide recognition of academic success, maximized learning time, district support, clear goals and high expectations, orderly and disciplined school environment, and leadership of principal characterized by attention to quality of instruction (Purkey & Smith, 1983).

These various models of school learning all contribute a variety of items, or variables, that may be useful to educational practitioners. Individual researchers may focus their work on particular variables or constructs, but the purpose of this synthesis was to try to provide a synoptic view of the entire panoply of variables.

Methods and Procedures

The first step in developing the meta-review described in this paper was to delineate a comprehensive set of variables organized into an inclusive conceptual framework. Next, a corpus of over 150 books, book chapters,

reports, and other sources was identified. The 228 items in the conceptual framework were listed on a detailed, fifteen-page coding form, and each of the sources was then coded using that form. In all, over 2,500 pages of coding forms were completed. Each citation or discussion of an item influencing learning outcomes was coded by page number, together with a notation of the reported strength of its influence on learning. These detailed text citations by page number have been placed in an archive.[3]

The detailed ratings were then recoded onto a set of summary forms, one for each chapter or other source, which gave overall ratings of strength of influence for each of the items discussed in that source. These summary ratings were entered into machine-readable files and analyzed to determine the emergent consensus on which items exert the most powerful influence on learning outcomes. The initial coding tabulated well over 10,000 separate statements in the research literature concerning of the strength of association between one of the 228 items and learning outcomes. These were reduced to over 3,700 summary ratings, which were then keyed and analyzed.[3]

Before describing the data analyses and the findings of this study, the development of the conceptual framework, selection of the corpus of studies, and coding procedures are briefly described.

Conceptual framework for items related to learning

The identification of a comprehensive set of items began with a close examination of the models of school learning described above, as well as selected sources, including Brophy (1986), Keogh, Major-Kingsley, Omori-Gordon, and Reid (1982), Wang and Walberg (1985), and Wittrock (1986). Potential variables were written on separate index cards, then consolidated and organized into a preliminary version of the final coding scheme. This draft coding scheme was sent to members of the Scientific Advisory Panel of the Center for Research in Human Development and Education at Temple University[4]. Based on detailed commentaries received from the Panel members, the framework was revised to include four additional items, and to improve its organization.

The final framework organized the 228 items related to learning into 30 a priori scales within six broad categories. The six categories were ordered roughly from more distal to more proximal factors. Brief descriptions of the categories are presented in Table 1, together with illustrative items from each scale.

Selection of a corpus of studies

A vast research literature addresses one or more of the potential learning influences represented by the conceptual framework, and it clearly would not be possible to examine all of the thousands of original studies relevant to a synthesis of this scope. Indeed, even the literature of review articles is massive. For this reason we focused on authoritative reviews and handbook chapters, especially those sponsored by the American Educational Research Association and other organizations, and selected additional syntheses in government documents and other sources. A preliminary list of sources was reviewed by the Scientific Advisory Panel, and revised following their recommendations. Following this review, the sources chosen included chapters from the past decade or more of the Review of Research in Education, the Annual Review of Psychology, and the Annual Review of Sociology, as well as the Handbook of Research on Teaching (Wittrock, 1986), Designs for Compensatory Education (Williams, Richmond, & Mason, 1986), more specialized handbooks, and a small number of journal articles chosen to assure coverage of all of the areas addressed in the comprehensive framework. Initially, over 200 articles, chapters, and other sources were identified. All of these sources were read, but some were excluded from the final corpus because they failed to address K-12 instruction in regular school settings, because they addressed exceptionally narrow and atypical learning outcomes, or because they were relevant only to rare or special-learner populations.

A total of 179 sources were included in the final corpus of studies (see Appendix for a complete bibliography). All of these were relevant to a range of cognitive and or affective learning outcomes for K-12 learners in formal

educational settings. Table 2 presents a summary by type of the source documents included in the final synthesis.

Coding procedures

Each source document was coded initially onto a detailed rating form, which allowed for the recording of multiple references in a single document to the same item. In addition to coding references to the 228 prespecified items, space was provided for the coding of any additional items related to learning outcomes, referred to on the form as supplementary items. Brief notes were also recorded for most sources, including page references, comments on the source's overall relevance, and any limitations on the learner populations and/or varieties of learning outcomes addressed. This archived documentation has been retained by the first author.

Each reference to an item's relation to learning outcomes was coded on a three-point scale, with "1" representing a weak, uncertain, or inconsistent relation to learning; "2" representing a moderate relation; and "3" representing a strong relation. Where "vote counts" or proportions of confirming studies were reported, a "3" indicated that more than 80 percent of the studies discussed had found a statistically significant association of an item to achievement; a "2" indicated that between 40 percent and 80 percent of the studies found support for the relationship; and a "1" indicated less than 40 percent in support. Where results were summarized in terms of effect sizes, a code of "3" was assigned to effect sizes greater than .33, "2" to effect sizes of .10 to .33, and "1" for smaller effect sizes. Where correlations were reported, "3" was used for correlations greater than .40, "2" for correlations of .15 to .40, and "1" otherwise.

In many cases, the source documents did not present quantitative indices like effect sizes or correlations, and so it was necessary to judge the strength of the evidence presented from prose descriptions of the conclusions from bodies of research. In these cases, the strength of the evidence presented was judged weak, moderate, or strong, and coded accordingly. Even though all of the 228 items were defined in such a way that they were expected to relate

positively to learning, there were rare instances in which negative conclusions from the literature were reported.[5]

Following the coding of all specific references by page number, ratings were transcribed onto a second, summary form for each source, prior to keying for data analysis. At this stage, a single, summary code -- the average of all the ratings for each source document -- was recorded indicating the strength of association for each item discussed in the source, according to the preponderance of the specific references noted.[6]

Data Analysis

After inspecting univariate frequency distributions for each of the 228 separate items to assure that no values were out of range, the separate items were aggregated to the level of the thirty scales described in Table 1. This was accomplished by taking the average of all non-missing values in a scale, for each source. In cases where a source document did not discuss any of the separate items in a scale, a missing data code was entered. In those rare cases where negative findings were coded, their negative signs were retained when averages were taken.

In a second stage of data reduction, six additional variables were created, corresponding to the categories described in Table 1. The values of these variables for each source were weighted averages of all nonmissing scale values comprised by that category.[7] Means, standard deviations, and alpha reliabilities for the six categories and thirty scales are presented in Table 3. The reliabilities for documents (not raters) range from .71 to .99. All but four are greater than .80, and most exceed .90[8].

Table 3 also reports the number of sources that discussed items in each scale. Surprisingly, the frequency with which different scale items are discussed in the literature is not a reliable guide to their importance for learning outcomes. The Spearman rank correlation between frequencies and means across the 30 scales is only .10.

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Summary of Results

Table 3 shows the importance of many distinct influences on school learning outcomes. Over all 30 scales, the mean rating was roughly 1.8, a little below the level designated "moderate relation to learning." More important, however, the synthesis shows which categories, scales, and specific items are most strongly associated with learning outcomes. In discussing results by category and by scale, relevant findings concerning specific items will be presented to clarify or elaborate the category- and scale-level findings reported in Table 3.

At the highest level of generality, this synthesis confirms the importance of the quality of schooling for learning outcomes. Of the six categories, the highest ratings overall were assigned to "Program Design Variables," followed by "Out of School Contextual Variables." The category reflecting the quality of instruction as delivered, "Classroom Instruction and Climate Variables," ranked third in importance, closely followed by "Student Variables." The last two categories, "School Level Variables" and "State and District Variables," received markedly lower ratings overall. This overall ranking of sources of influence contrasts sharply with the "conventional wisdom" since the time of the Equality .. Educational Opportunity (EEO) Survey (Coleman, et al., 1966) that quality of schooling has relatively little impact on schooling outcomes relative to out-of-school, socioeconomic variables.

The importance of proximal psychological variables may be seen in the scales that obtained the highest ratings.[9] Those scales with mean ratings of 2.00 or greater were (beginning with the highest):

- Metacognition X = 2.08
- Classroom Management X = 2.07
- Quantity of Instruction X = 2.02
- Student/Teacher Interactions: Social X = 2.02
- Classroom Climate X = 2.01
- Peer Group Influences X = 2.00

In the remainder of this section, the categories and scales are discussed in turn, and those scales and items that received exceptionally high ratings are highlighted. The categories representing instruction as designed and

instruction as delivered are discussed first. These are followed by out-of-school context and student characteristics. Finally, the more distal variable categories of school level variables and state and district variables are addressed.

Program Design Variables

This category includes instruction as designed, and the physical arrangements for its delivery, organized into three scales, as shown in Tables 1 and 3. The scale "Demographic and Marker Variables" was rated highest of the three, and within this scale the most highly rated items are "size of instructional group (whole class, small group, or one-on-one instruction)," "number of classroom aides," and "resources needed." (Ratings for these items ranged from 1.95 to 2.00.) Thus, the most important aspect of program design appears to be the intensity of educational services provided to each learner. More aides, smaller groups, or increased material resources are associated with significantly higher learning outcomes.

"Curriculum and Instructional Variables" includes a number of items with average ratings above 2.0 (moderate relation to learning). The highest rated of these suggest that the key to effective instructional design is the flexible and appropriate use of a variety of instructional strategies, while maintaining an orderly classroom environment. The highest overall rating in this scale was for "Use of ... techniques to control classroom disruptiveness." This item was followed by "use of prescriptive instruction combined with aspects of informal or open education" and "presence of information in the curriculum on individual differences and commonalities," both of which explicitly relate to student diversity and individualization. Other highly rated items referred to specific instructional strategies, including "use of mastery learning techniques, ... instructional cues, engagement, and corrective feedback, " "use of cooperative learning strategies," and "use of diagnostic-prescriptive methods."

"Curriculum Design" also includes several items with average ratings near 2.0, although none exceeds the "moderate" level. High ratings were given to "materials employ alternative modes of representation" and "degree of structure

in curriculum accommodates needs of different learners," both of which reinforce the importance of offering a variety of instructional materials and approaches to accommodate individual differences. The importance of the organization of curriculum content is revealed by two highest-rated items in this scale, "materials employ learning hierarchies" and "material is presented in a cognitively efficient manner."

Implementation, Classroom Instruction, and Climate Variables

This category includes support of the curriculum and the instructional program; classroom routines; specific instructional, assessment, and classroom management practices; quantity of instruction; academic and nonacademic student-teacher interaction; and classroom climate. It is by far the largest of the six categories, comprising 79 of the 228 items and eight of the thirty scales. Half of these scales had mean ratings above 2.00, placing them among the most influential scales overall.

High ratings in the areas of implementation, classroom instruction, and climate again point up the importance of maintaining an orderly classroom environment and providing clear, well organized instruction appropriate to the needs of individual learners. In the overall ranking of all 30 scales, "Classroom Management" ranked second. Its most critical items were "group alerting (teacher uses questioning/recitation strategies that maintain active participation by all students)" and "learner accountability (teacher maintains student awareness of learning goals and expectations)." Smooth transitions from one instructional activity to another, minimal disruptions, and teacher awareness of what is going on in the classroom at all times also received mean ratings above 2.00.

"Quantity of Instruction" was ranked third overall, following "Classroom Management." It includes time spent in direct instruction, especially direct instruction on basic skills; time spent on homework; and length of the school day and the school year. The importance accorded quantity of instruction is not surprising. This construct has appeared in many of the most widely cited models of school learning (Haertel, Weinstein, & Walberg, 1983).

"Student/Teacher Interactions: Social" ranked fourth overall, and "Classroom Climate" was ranked fifth. The high ranking for social interactions was almost entirely due to just two items with mean ratings of 2.00 or greater: "teacher reacts appropriately to correct and incorrect answers," and "student responds positively to questions from other students and from teacher."[10] "Classroom climate" included fifteen items with ratings of 2.00 or greater. Taken together, the highly rated items in these two scales characterize a classroom in which teacher and students interact considerately and cooperatively, where students work with several classmates, share common interests and values, and pursue cooperative goals. Students are actively engaged in learning, and are involved in making some types of classroom decisions. At the same time, the class is well organized and well planned, with a clear academic focus. Objectives of learning activities are specific and explicit, and students feel continually and appropriately challenged, with the pacing of instruction appropriate for the majority.

The remaining scales under "Implementation, Classroom Instruction, and Climate Variables" have much lower overall ratings, but include more than twenty specific items with means of 2.00 or greater. The majority of these items refer to instructional organization, and to mechanisms for assuring that students understand that organization and the goals of instruction. For example, high ratings were given to use of advance organizers and directing students' attention to the content to be learned; and to clear and organized direct instruction, systematic sequencing of lesson events, and clear lesson transitions. Other highly rated items included corrective feedback in case of student error, frequent academic questions, and accurate measurement of skills. Finally, the literature strongly supports the teaching of skills in the context of meaningful application, use of good examples and analogies, and teaching for meaningful understanding, together with explicit promotion of student self-monitoring of comprehension and gradual transfer of responsibility for learning from the teacher to the student.

Extramural Variables

This category includes items associated with the home and community contexts within which schools function. As presented above, "Peer Group Variables" was ranked sixth among all scales. This was due primarily to the emphasis placed on peers' educational and occupational aspirations, both of which had mean ratings of 2.00 or higher.

Additional highly rated items in this category reflected parental interest and involvement in students' school work. For example, "parental involvement in assuring completion of homework," "parental participation in school conferences and related activities," and "parental interest in students' school work" all received high ratings. The educational environment of the home (e.g., number of books and magazines) was also cited in numerous sources, and received consistently high ratings. Student participation in clubs and extracurricular school activities and time spent on leisure reading were also moderately related to learning outcomes.

Student Variables

These are items associated with individual students themselves, including demographics, academic history, and various social, cognitive, and affective characteristics. Among these items, the one with the highest rating was "psychomotor skills specific to area instructed," with a rating of 2.33. This was the only item included in the "Psychomotor Variables" scale. However, as explained above, this mean is based on only six sources. It is best regarded as a statistical artifact, and will not be further discussed.

"Metacognitive Variables" received the highest mean ratings of any of the remaining scales in the entire framework. Highly rated metacognitive items include "comprehension monitoring (planning; monitoring effectiveness of attempted actions; testing, revising, and evaluating learning strategies)," "self-regulatory, self-control strategies (e.g., control of attention)," and "positive strategies to facilitate generalization of concepts."

A number of specific items in the remaining "Student Variables" scales also had high ratings, including positive behavior and ability to make friends with peers, motivation for continual learning, and perseverance on learning tasks. Highly rated items from the "Cognitive" scale included several representing general mental abilities, levels of basic skills sufficient to profit from instruction, and prior knowledge in the subject area instructed.

School Level Variables, and State and District Variables

Educational policy items at the school, district, and state levels appear from this research synthesis to have relatively little association with learning outcomes, as shown by low mean ratings for categories and scales. A few items in this area received mean ratings of 2.00 or higher, but nearly all of these were based on fewer than ten sources. Nonetheless, several school-level educational practices emerged as important. These included the presence of an "effective schools" program; explicit school grading, academic progress, and attendance policies; and a safe and orderly school climate. Peer and cross-age tutoring, which were classified as school-level variables when their implementation required coordination among self-contained classrooms, also received moderate or higher ratings based on discussions in more than ten sources.

Discussion

This research synthesis confirms that distal policy variables are less important to schooling outcomes than quantity and quality of instruction, home environment, or student characteristics. Of the six categories in the conceptual framework (See Tables 1 and 3), "State and District Variables" and "School Level Variables," both comprising mainly policy variables, had markedly lower mean ratings than the remaining four categories. The items most important to learning outcomes are those that are directly tied to students' engagement with the material to be learned.

In contrast to the earlier view that quality of schooling is of little importance relative to out-of-school factors (e.g., Coleman, et al., 1966), this

synthesis also suggests that from kindergarten through the twelfth grade, across a range of content areas and educational contexts, quality and quantity of instruction are roughly equal in importance to student characteristics and out-of-school contextual items.

Furthermore, the present synthesis of educational research is considerably more comprehensive than What Works: Research About Teaching and Learning, the widely-distributed pamphlet of the U.S. Department of Education (1986); it contains both highly effective and relatively less effective practices. The present synthesis, moreover, draws on a larger body of literature, and contains a more explicit methodology that can be replicated by other investigators. It contains some 228 practices in comparison with 41 in the original What Works (and 62 in the second edition); and it gives a numerical rating to each one as well as composites. Yet none of the findings of What Works and the present work are discordant. What Works contains specific findings and elaborates on and illustrates various techniques. Such techniques are described specifically enough to be understood by parents and teachers; perhaps they might even be put into practice without assistance.

To be useful to practitioners, the present findings, many of which are abstract and concern more complex practices, would have to be further described and exemplified. To accomplish this, reviewers would have to return to the review literature and perhaps the original studies to analyze the specific operational definitions of techniques. These would require translation into plain language and prescriptive practices. Many are sufficiently complex that they could not be implemented without training and staff development. Such an effort would be considerable but worthwhile.

Turning from the level of the six broad categories to the thirty scales, those identified as most important to good learning outcomes are student metacognition, effective classroom management, quantity of instruction, positive and productive student/teacher Interactions, a classroom climate conducive to learning, and a peer culture supportive of academic achievement. These broad conclusions are supported by a number of more specific findings from the research synthesis. These selected findings are highlighted below.

Student characteristics

Individual differences among students have long been recognized as critical determinants of learning outcomes, but it was both surprising and encouraging that in this synthesis the metacognitive items emerged as most important, including comprehension monitoring, use of self-regulatory, self-control strategies, and use of strategies to facilitate generalization of concepts. Metacognitive variables are heavily cited in the current literature, in contrast to an earlier focus on relatively stable general mental abilities. A better understanding of these alterable variables may ultimately help the great majority of students to reach higher achievement levels through appropriate training in metacognition. Two additional student items accorded importance in the research literature were "perseverance on learning tasks" and "motivation for continual learning." Both of these reinforce the conclusion that consistent engagement with the subject matter to be learned is critical to school success.

Quality and quantity of instruction

Classroom management and climate and student-teacher interactions represent an important constellation of variables related to effective instruction. Detailed examination of the highly rated items in these areas reveals a portrait of cooperative, cohesive, goal-directed classrooms in which a variety of educational approaches and activities are employed. Items heavily cited in the research literature include sound organization and systematic sequencing of instruction, and effective use of direct, teacher-centered instruction. Among other instructional approaches frequently linked to positive learning outcomes were peer and cross-age tutoring and cooperative group learning strategies.

Several items associated with quantity of instruction also emerged as important, including student time on task, length of school day and school year, amount of time allocated to direct instruction in basic skills, and time spent out of school on homework and on leisure reading. Of these, the most

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frequently cited variable is time on task. These time-related variables have clearly become well established and widely accepted as determinants of learning outcomes, in spite of criticisms cited by (Shulman, 1986) of time as an "empty vessel."

Out of school context

There has been increasing attention in the research literature to the role of parental involvement and support variables in promoting student learning. The synthesis affirmed the importance of these items, as well as peer group influences. These findings were reflected in ratings for parental involvement in school activities, interest in schoolwork, and monitoring of school attendance and homework completion. Parental support might also be mediated through influence on students' selection of friends. Peer group variables, especially academic and occupational aspirations, were found to be strongly related to school success.

Strength of influences on school learning

Physical processes can often be explained as functions of a small number of variables interacting in simple ways. In contrast, schooling processes respond to a multitude of influences interacting in kaleidoscopic patterns. This research synthesis has confirmed that a large number of variables are moderately related to learning outcomes, but few if any single variables are very strongly related to learning. Authors of original research studies and of reviews and syntheses are appropriately cautious in stating the importance of particular items, and their caution is reflected in the relatively narrow range of mean ratings shown in Table 3. Nonetheless, taken together, the items examined in this synthesis are powerful determinants of school effects.

The conclusions discussed in this section are based on what appears to be the most comprehensive analysis of the literature on effective educational practices for regular and special education. Related work involving the consensus of the panel of experts, the authors of research reviews, and regular

and special practitioners adds further support to the conclusions (Wang, Walberg, & Reynolds, 1989; Reynolds, Wang, & Walberg, 1989).

Still, certain caveats should be noted: It cannot be determined from the analyses, for example, what actual effect sizes will result; the analyses merely estimate their relative sizes. In addition, the analyses yield neither actual nor relative estimates of combinations of practices. It would seem reasonable to suppose that implementation of more practices with the highest estimates would yield the largest effects, but this supposition is a matter for subsequent empirical research.

Another caveat applies to the content analysis of research literature on group-level effects, notably the literature on effective schools. Some of the effective schools factors have been analyzed in relation to school averages on achievement tests. Such relationships might be found somewhat larger or smaller if calculated for individual children. It can be expected that expert reviewers on this subject (on which the syntheses depend) would take this uncertainty into consideration in interpreting their findings. It has rarely been demonstrated that techniques that work for the average student have deleterious consequences for other students' learning.

Nonetheless, it is worth keeping this limitation in mind in interpreting the findings and in tracing their implications. There are many other cautions that ordinarily apply to educational research, such as the possibility that effective methods found a decade ago no longer apply today. These are obvious enough to leave to researchers and experienced educators as they think about how the findings apply in their own situations.

NOTES

1. This research was supported in part by the Temple University Center for Research in Human Development and Education, and in part by a grant from the U. S. Department of Education's Office of Special Education and Rehabilitative Services. The opinions expressed herein are solely those of the authors, and no official endorsement should be inferred.

2. Copies of the detailed coding form and complete bibliographic citations for the 179 sources, as well as copies of the data archive are available from Dr. Margaret C. Wang at the Center for Research in Human Development and Education, Ritter Hall Annex, 9th Floor, Temple University, Philadelphia, PA 19122.

3. In addition to the coding and analysis of the 179 source documents, a survey was also conducted of the authors of all major source documents examined. The summary coding form described below was distributed to authors, with a request to provide overall ratings of the importance of the 228 items to learning outcomes. A total of 78 forms were returned. These expert ratings were analyzed separately from the source document ratings, following identical procedures. Results were highly similar, with the exception that the experts generally tended to give somewhat higher numerical ratings.

4. This panel included 12 prominent experts in areas of research on teaching, education, educational psychology, and special education.

5. Most of these occurred for items in the scale, "History of Educational Placements," which accounts for the low mean of this variable in Table 3.

6. If any supplementary items had been coded, these were reexamined as the forms were transcribed, and whenever possible were included under one of the prespecified items. This was generally possible because most supplementary items documented authors' more detailed or specific empirical conclusions, for example, specific types of motivation related to learning, or particular variants

of instructional practices. Such detailed findings were incorporated into the broader variable prespecified on the form. The other major group of supplementary items were those documenting two-way or occasionally higher-order interactions. Because interactions represent more subtle findings and frequently fail to replicate, they were not transferred from the detailed form to the summary form. The summary forms were keyed and verified, and files were prepared for data analysis using standard statistical software packages.

7. The weights used were equal to the numbers of original items included in the respective scales. Note that if there were no missing data, this procedure would result in giving all of the original items in a broad category equal weight. Where some items in a scale are missing, this procedure in effect assigns the mean of the nonmissing scale items to those missing observations. For any given scale, about 15 percent of the values of items on average were missing.

8. As noted in the footnote to the table, these reported reliabilities are for means of all the items in a given category or scale. Due to missing data, values for some sources were based on means of fewer items.

9. The highest ratings overall were assigned to "Psychomotor Variables," and a moderately high rating was also assigned to the scale "Accessibility Variables." However, only one item was included in each of these scales, and these items were referred to in six or fewer of the 179 sources analyzed. Thus, "Psychomotor Variables" and "Accessibility Variables" were set aside. The list of scales with the highest ratings include the 28 scales with more items and more ratings.

10. A third item in this scale, "teacher provides explicit coaching to reduce aggression," also received a mean rating above 2.00, but was mentioned in only 4 of the 179 sources. This item is of limited relevance in most regular educational settings.

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Table 1

Conceptual Framework with Illustrative Examples

Category/Subcategory[a]	Illustrative Variable
Category I. State and District Variables: These are variables associated with state and district level school governance and administration. They include state curriculum and textbook policies, testing and graduation requirements, and teacher licensure; as well as specific provisions in teacher contracts, and some district-level administrative and fiscal variables.	
District Level Demographics and Marker Variables	School district size
State Level Policy Variables	Teacher licensure requirements
Category II. Out of School Contextual Variables: These are variables associated with the home and community contexts within which schools function. They include community demographics, peer culture, parental support and involvement, and amount of time students spend out-of-school on such activities as television viewing, leisure reading, and homework.	
Community Variables	Socioeconomic level of community
Peer Group Variables	Level of peers' academic aspirations
Home Environment and Parental Support Variables	Parental involvement in assuring completion of homework
Student Use of Out of School Time Variables	Student participation in clubs and extracurricular school activities
Category III. School Level Variables: These are variables associated with school-level demographics, culture, climate, policies, and practices. They include demographics of the student body, whether the school is public or private, and levels of funding for specific categorical programs; school-level decision making variables, and specific school-level policies and practices, including policies on parental involvement in the school.	
Demographic and Marker Variables	Size of school
Teacher/Administrator Decision Making Variables	Principal actively concerned with instructional program

Table 1 (Category III, continued)

Category/Subcategory	Illustrative Variable
School Culture Variables (Ethos Conducive to Teaching and Learning)	School-wide emphasis on and recognition of academic achievement
School-Wide Policy and Organizational Variables	Explicit school-wide discipline policy
Accessibility Variables	Accessibility of educational program (overcoming architectural, communication, and environmental barriers)
Parental Involvement Policy Variables	Parental involvement in improvement and operation of instructional programs

Category IV: Student Variables: These are variables associated with individual students themselves, including demographics, academic history, and a variety of social, behavioral, motivational, cognitive, and affective characteristics.

Demographic and Marker Variables	Gender
History of Educational Placement	Prior grade retentions
Social and Behavioral Variables	Positive, nondisruptive behavior
Motivational and Affective Variables	Attitude toward subject matter instructed
Cognitive Variables	Level of specific academic knowledge in subject area instructed
Metacognitive Variables	Comprehension monitoring (planning: monitoring effectiveness of attempted actions; monitoring outcomes of actions; testing, revising, and evaluating learning strategies)
Psychomotor Variables	Psychomotor skills specific to area instructed

Table 1 (continued)

Category/Subcategory	Illustrative Variable
Category V. Program Design Variables: These are variables associated with instruction as designed, and with the physical arrangements for its delivery. They include the instructional strategies specified by the curriculum, and characteristics of instructional materials.	
Demographic and Marker Variables	Size of instructional group (whole class, small group, one-on-one instruction)
Curriculum and Instructional Variables	Alignment among goals, contents, instruction, assignments, and evaluation
Curriculum Design Variables	Materials employ advance organizers
Category VI. Implementation, Classroom Instruction, and Climate Variables: These are variables associated with the implementation of the curriculum and the instructional program. They include classroom routines and practices, characteristics of instruction as delivered, classroom management, monitoring of student progress, and quality and quantity of instruction provided, as well as student-teacher interactions and classroom climate.	
Classroom Implementation Support Variables	Establishing efficient classroom routines and communicating rules and procedures
Classroom Instructional Variables	Use of clear and organized direct instruction
Quantity of Instruction Variables	Time on task (amount of time students are actively engaged in learning)
Classroom Assessment Variables	Use of assessment as a frequent, integral component of instruction
Classroom Management Variables	Group alerting (teacher uses questioning/recitation strategies that maintain active participation by all students)

Table 1 (Category VI, continued)

Category/Subcategory	Illustrative Variable
Student and Teacher Interactions: Social Variables	Student responds positively to questions from other students and from teacher
Student and Teacher Interactions: Academic Variables	Frequent calls for extended, substantive oral and written response (not one-word answers)
Classroom Climate Variables	Cohesiveness (members of class are friends sharing common interests and values and emphasizing cooperative goals)

*Subcategories are listed below the description of each broad category, and are each illustrated with representative variables. For example, the first broad category includes two subcategories, "District Level Demographics and Marker Variables," and "State Level Policy Variables."

Table 2

Number and Percent of Source Documents by Type

Type of Source[a]	N	Percent	Total Pages
Chapters from Annual Review Series	86	48	3,179
Handbook Chapters	44	25	1,089
Government Documents and Commissioned Reports	20	11	772
Book Chapters	18	10	563
Review Articles in Journals	11	6	152
Total	179	100	5,755

[a]A complete bibliography is available from the first author

Table 3

Reliabilities, means, standard deviations, and frequencies for source ratings

Category/Subcategory	Reliability[a]	Mean	S.D.	Frequency
State and District Variables	.90	1.22	.81	27
District demographics & marker vars.	.95	1.46	.50	14
State level policy variables	N.C.	1.24	1.00	19
Out of School Contextual Variables	.99	1.87	.39	59
Community variables	N.C.	1.80	.41	15
Peer group variables	.98	2.00	.34	18
Home environment & parental support	.95	1.90	.40	47
Student use of out-of-school time	N.C.	1.94	.46	17
School Level Variables	.95	1.54	.96	102
Demographics and marker variables	.91	1.74	.56	25
Teacher/administrator decision making	.87	1.65	.95	21
School culture variables	.87	1.84	.43	49
School-wide policies and organization	.76	1.40	1.14	74
Accessibility variables	N.C.	2.00	.00	2
Parental involvement policy variables	N.C.	1.67	.56	23
Student Variables	.92	1.83	.57	155
Demographics and marker variables	.71	1.70	.77	90
History of educational placements	N.C.	0.16	1.80	19
Social and behavioral variables	.80	1.98	.34	35
Motivational and affective variables	.91	1.93	.42	81
Cognitive variables	.88	1.98	.33	101
Metacognitivie variables	.91	2.08	.36	76
Psychomotor variables	N.C.	2.33	.52	6
Program Design Variables	.90	1.90	.38	142
Demographic and marker variables	N.C.	1.97	.54	23
Curriculum and instruction variables	.90	1.92	.46	108
Curriculum design variables	.89	1.88	.34	97
Classroom Instruction and Climate Variables	.97	1.84	.66	165
Classroom implementation support	.85	1.84	.38	66
Classroom instructional variables	.89	1.85	.74	156
Quantity of instruction variables	.94	2.02	.64	69
Classroom assessment variables	N.C.	1.89	.30	61
Classroom management variables	.98	2.07	.23	42
Student/teacher interactions: Social	.73	2.02	.41	44
Student/teacher interactions: Academic	.77	1.89	.44	29
Classroom climate variables	.99	2.01	.38	75

[a]Coefficient alpha reliabilities were estimated for each scale from average variances and inter-item covariances. Due to missing data, ratings for some cases are based on fewer items. Thus, obtained reliabilities are somewhat lower than the figures reported in this table. "N.C." indicates values that were not calculable, either because scales consisted of only a single item, or due to patterns of missing data.

APPENDIX

Bibliographic References for the 179 Sources Synthesized in

What Influences Learning? A Content Analysis of Review Literature

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Bibliographic References for the 179 Sources Synthesized in

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